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Smart Bag for Women Safety Using Arduino

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Abstract
Women safety has become a major concern due to increasing cases of violence and harassment. To address this issue, we have developed a smart bag using Arduino technology with various features such as GPS tracking, GSM module, SOS button, DC pump motor for spray mechanism, and Bluetooth module. The smart bag is designed to provide women with a sense of security and peace of mind when they are out and about. The GPS tracking feature allows the user to track their location in real-time, while the GSM module enables them to send distress signals to emergency contacts or authorities in case of any danger. The SOS button can be activated quickly in case of an emergency, triggering immediate alerts and notifications to per-set contacts. The DC pump motor for spray mechanism can be used as a self-defense tool to deter attackers by spraying a non-lethal liquid. Additionally, the Bluetooth module allows seamless communication between the smart bag and a dedicated mobile app, which can be used to operate various commands like setting up geofencing zones or monitoring battery levels. Overall, this project aims to leverage technological advancements to enhance women's safety today and empower them to navigate the world with confidence and peace of mind.

KEYWORDS: Arduino, GPS module, GSM module, SOS Button, Bluetooth Module, Dc Pump motor.

INTRODUCTION

In the era of smart technology, personal accessories are evolving to offer more than just basic functionality. The Smart Bag project is at the forefront of this evolution, embedding cutting-edge technology intoa conventional item. With Arduino Uno at its core, the Smart Bag is equipped with switches for user control, GSM- GPS modules for global positioning and communication, and a motor controlled by a relay for automated actions. This project aims to redefine personal belongings, offering enhanced features that improve user experience, security, and convenience. Moreover, the Smart Bag's interactive capabilities extend beyond simple notifications and tracking. It integrates with smartphone applications and wearable devices, enabling a synchronized network of personal technology that works cohesively to enhance efficiency and ease of use. Through this connectivity, users can receive alerts about forgotten items, track usage patterns, and even receive suggestions for packing based on weather forecasts or planned activities, exemplifying a personalized and proactive approach to daily tasks. The sustainability aspect of the Smart Bag also deserves mention. Designed with eco-friendly materials and energy-efficient technology, the bag not only serves the user's immediate needs but also addresses broader environmental concerns. Its rechargeable power system, often sourced from solar panels integrated into the bag's design, ensures a continuous supply of energy, reducing reliance on disposable batteries and minimizing the carbon footprint.In the broader scope of smart technology integration, the Smart Bag represents a shift towards more intuitive and user-friendly personal accessories. Its development reflects a deep understanding of the modern lifestyle, where convenience, security, and sustainability are paramount. As this project continues to evolve, it will undoubtedly incorporate more advanced technologies such as AI-driven personal assistants, augmented reality for navigation and item management, and even blockchain for secure and transparent transactions.

Fig1:Womens using Smart bag in our locality

LITERATURESURVY

We had the opportunity to study several initiatives, journals, articles, and books that were relevant to the project's title as it developed. We think that every item that was studied was beneficial to the overall development and design of the project that we ultimately decided on. A few of the similar projects that we have examined are included in this section.

Smart Bag Systems and IoT Technology:

Research in the field of smart bags leverages IoT technology to enhance functionality and user experience. Studies by authors like Chen et al. (2021) and Singh et al. (2019) explore the integration of IoT sensors in bags to monitor location, security, and content weight, facilitating real-time tracking and management through mobile apps. IoT-enabled smart bags can connect to cloud platforms, allowing for data analysis and personalized notifications based on user behavior and bag contents. This integration not only improves convenience but also enhances security features, as demonstrated by Lee et al. (2020), who developed algorithms for theft detection and unauthorized access alerts in smart bags.

Wearable Sensors in Smart Bag Design:

Wearable sensors are pivotal in the evolution of smart bags, providing insights into user interactions and environmental conditions. Research by Patel et al. (2018) and Kumar et al. (2020) shows how pressure sensors, accelerometers, and RFID tags can be incorporated into bags to monitor handling, usage patterns, and iteminventory. These sensors enable smart bags to adapt to user needs, such as automatically illuminating the interior based on ambient light conditions or alerting users to misplaced items, as highlighted in the work of Zhao et al. (2019)

Integration of Smart Textiles in Smart Bags

The integration of smart textiles into bag design represents a significant advancement in the functionality and aesthetics of smart bags. Studies by Gupta et al. (2021) and Sharma et al. (2018) discuss the use of conductive fabrics and e-textiles that allow for embedded electronic components and sensors without compromising the bag's flexibility or comfort. These materials can be used to create interactive surfaces on bags, enabling touch-sensitive controls and displays that provide user feedback and control functionality, as explored by Jansen et al

Smart Bag Communication and Software Integration

Effective communication and software integration are crucial for maximizing the potential of smart bags. Research by Wong et al. (2020) and Ali et al. (2019) investigates the use of Bluetooth, Wi-Fi, and NFC for seamless connectivity between smart bags and other devices like smartphones and tablets. This connectivity allows for the development of dedicated apps that offer features such as remote locking/unlocking, finding the bag’s location, and checking the bag’s status or contents through an intuitive user interface.

This revised literature review focuses on the technological components and research developments pertinent to smart bag systems, covering IoT integration, wearable sensors, smart textiles, and the necessary communication and software integration.

EXISTING SYSTEM

In the landscape of personal carry-on items, the existing system predominantly revolves around conventional bags that serve the basic function of carrying and storing personal belongings. These traditional bags, while practical, lack the integration of technology and thus offer limited functionality beyond storage. They do not provide any means of security, tracking, or interaction with the user's digital lifestyle. In stark contrast, the Smart Bag project revolutionizes this paradigm by infusing advanced technological elements into the fabric of the bag itself. Unlike the existing system, which relies on passive, unsecured, and isolated storage solutions, the Smart Bag introduces a dynamic and interactive ecosystem. This new system incorporates real-time tracking through GSM-GPS modules, automated physical responses via a relay-controlled motor, and user interaction through integrated switches, vastly enhancing the user experience, security, and convenience of personal belongings. This transition from a mere storage device to an intelligent, connected accessory represents a significant leap forward, aligning with the evolving needs and expectations of modern users who seek more from their personal accessories inthe era of smart technology.

PROPOSED SYSTEM

The proposed system for the Smart Bag aims to revolutionize the concept of personal carry-on items by incorporating sophisticated technology to enhance functionality, security, and user interaction. Unlike traditional bags that serve primarily as storage items, the Smart Bag is designed to be an intelligent, interactive, and secure companion for the modern user. Here's a detailed look at the proposed System.

Integration of Advanced Technology:

At the core of the proposed system is the Arduino Uno, a powerful microcontroller that orchestrates the functionality of the Smart Bag. Thissystem leverages real-time data processing and communication capabilities to offer a seamless and interactive user experience.

Enhanced Security Features:

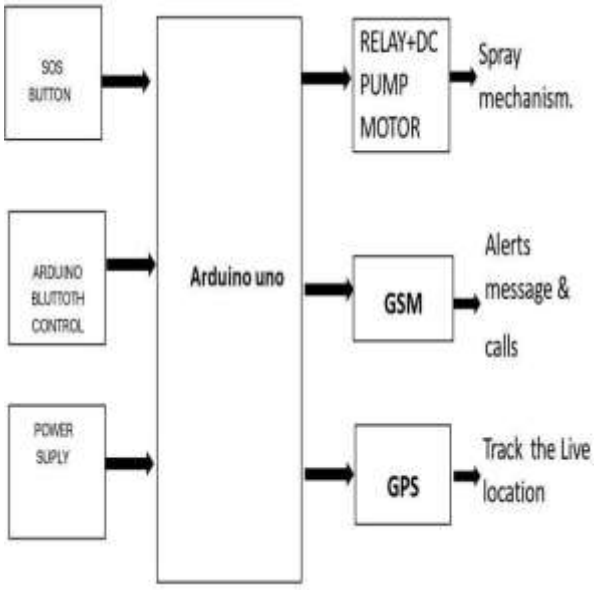
Security is paramount in the proposed system. With integrated GSM-GPS modules, the Smart Bag allows for real-time location tracking, enabling users to always monitor their bag's whereabouts. In addition, the bag can be equipped with sensors to detect unauthorized access or tampering, immediately alerting the user through a connected mobile app.

Automated and Responsive Actions:

A key feature of the proposed system is its ability to perform automated actions. A relay-controlled motor can activate locking mechanisms, adjust the bag's configuration, or even expand storage space as needed, all of which can be controlled remotely via user commands or predefined settings based on the user's schedule and habits.

User-Centric Design and Interaction:

The proposed system emphasizes user interaction and personalization. With integrated switches and touch panels, users can interact with the Smart Bag directly, customizing settings, and preferences to suit their needs. This interaction extends to a mobile app, providing a comprehensive platform for managing the bag's features, tracking history, and receiving notifications.



SOFTWARE

The Arduino IDE is an open-source software, which is used to write and upload code to the Arduino boards. The IDE application is suitable for different operating systems such as Windows, Mac OS X, and Linux. It supports the programming languages C and C++. Here, IDE stands for Integrated Development Environment.

The program or code written in the Arduino IDE is often called as sketching. We need to connect the Genuine and Arduino board with the IDE to upload the sketch written in the Arduino IDE software. The sketch is saved with the extension '.ino.'

The icons displayed on the toolbar are New, Open, Save, Upload, and Verify.

The Upload button compiles and runs our code written on the screen. It further uploads the code to the connected board. Before uploading the sketch, we need to make sure that the correct board and ports are selected.

We also need a USB connection to connect the board and the computer. Once all the above measures are done, click on the Upload button present on the toolbar.

The latest Arduino boards can be reset automatically before beginning with Upload. In the older boards, we need to press the Reset button present on it. As soon as the uploading is done successfully, we can notice the blink of the Tx and Rx LED.

If the uploading is failed, it will display the message in the error window.

We do not require any additional hardware to upload our sketch using the Arduino Bootloader. A Bootloader is defined as a small program, which is loaded in the microcontroller present on the board.

The LED will blink on PIN 13.

The Open button is used to open the already created file. The selected file will be opened in the current window.

The save button is used to save the current sketch or code.

It is used to create a new sketch or opens a new window.

The Verify button is used to check the compilation error of the sketch or the written code.

The serial monitor button is present on the right corner of the toolbar. It opens the serial monitor.

When we connect the serial monitor, the board will reset on the operating system Windows, Linux, and Mac OS X. If we want to process the control characters in our sketch, we need to use an external terminal program. The terminal program should be connected to the COM port, which will be assigned when we connect the board to the computer

When we click on the File button on the Menu bar, a drop-down list will appear.

New button opens the new window. It does not remove the sketch which is already present.

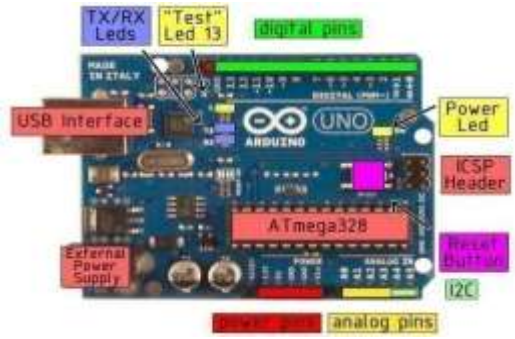
It allows opening the sketch, which can be browsed from the folders and computer drivers.

The Open Recent button contains the list of the recent sketches.
It stores the current sketches created in the Arduino IDE software. It opens the selected sketch or code in a new editor at an instance.

HARDWARE COMPONENTS

ARDUINO UNO

The Arduino Uno is a micro controller board based on the ATmega328 (data sheet). It has 14 digital input/output pins (of which 6 canbe used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and reset button. It contains everything needed to support the micro controller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or batteryto get started. The Uno differs from all preceding boards in that it does not use the FTDIUSB- to- serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter. "Uno" means one in Italian and isnamed to mark the upcoming release of Arduino 1.0. The Uno and version1.0 will be the reference versions of Arduno, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform.

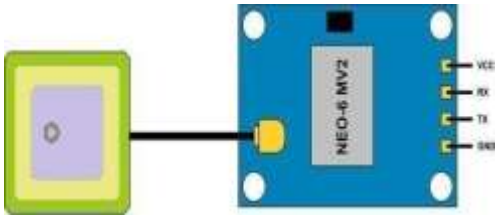


- Microcontroller: ATmega328
- Operating Voltage: 5V
- Input Voltage (recommended): 7-12V
- Input Voltage (limits): 6-20V
- Digital I/O Pins 14 (of which 6 provide PWM output)
- Analog Input Pins 6
- DC Current per I/O Pin 40 mA
- DC Current for 3.3V Pin 50 mA
- Flash Memory32 KB of which 0.5 KB used by bootloader
- SRAM 2 KB
- EEPROM 1 KB
- Clock Speed 16 MHz

NEO-6MV2 GPS Module

The NEO-6MV2 is a GPS (Global Positioning System) module and is used for navigation. The module simply checks its location on earth and provides output data which is longitude and latitude of its position.It is from a family of stand-alone GPS receivers featuring the high performance u-blox 6 positioning engine. These flexible and cost effective receivers offer numerous connectivity options in a miniature (16 x 12.2 x 2.4 mm) package. Thecompact architecture, power and memory options make NEO-6 modules ideal for battery operated mobile devices with very strict cost and space constraints. Its

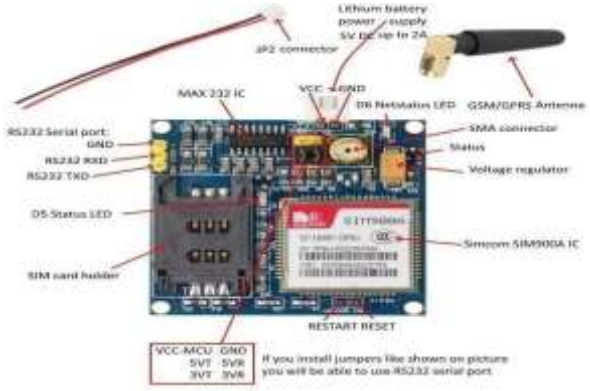
Innovative design gives NEO- 6MV2 excellent navigation performance even in the most challenging environments.



- Standalone GPS receiver
- Anti-jamming technology
- UART Interface at the output pins (Can use SPI ,I2C and USB by soldering pins to the chip core)
- Under 1 second time-to-first-fix for hot and aided starts
- Receiver type: 50 Channels - GPS L1 frequency - SBAS (WAAS, EGNOS, MSAS, GAGAN)
- Time-To-First-fix: For Cold Start 32s, For Warm Start 23s, For Hot Start
- <1s
- Maximumnavigation update rate: 5Hz
- Default baud rate: 9600bps
- EEPROM with battery backup
- Sensitivity: -160dBm

GSM -900I MODULE

The GSM 900i model is a variant of the Global System for Mobile Communications (GSM) technology, specifically operating in the 900 MHz frequency band. GSM 900i is a mobile phone standard widely used across many parts of the world, offering voice communication, text messaging (SMS), and basic data services. It represents a key milestone in the evolution of mobile communication technology, providing users with reliable and widespread cellular connectivity. The GSM 900i model typically features a compact and lightweight design, making it portable and convenient for everyday use. It incorporates a variety of features aimed at enhancing user experience and functionality, including a built-in antenna, alphanumerickeypad for input, monochrome display for viewing messages and call information, and a rechargeable battery for powering the device on the go. Additionally, the GSM 900i model may support additional features such as caller ID, address book, and basic internet browsing capabilities, depending on the specific implementation by manufacturers.As a GSM 900 variant, the GSM 900i model operates within the 900 MHz frequency band, which is commonly utilized by GSM networks in many regions worldwide. This frequency band offers good coverage and penetration, particularly in urban and suburban areas, as well as in rural areas with adequate network infrastructure. Users of the GSM 900i model can expect reliable cellular connectivity and network access, enabling them to stay connected with friends, family, and colleagues wherever they go.

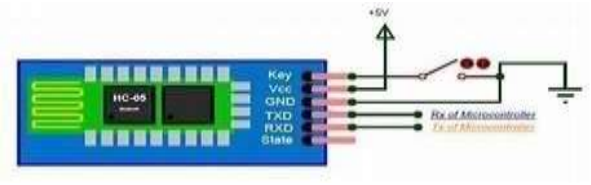


- Frequency Band: Operates in the GSM 900 MHz frequency band.
- Voice Communication: Supportsvoice calls over cellular networks.
- SMS Messaging: Enables sending and receiving of text messages (SMS).
- Data Transmission: Allows for basic data transmission, typically for services like internet browsing and email (limited by the capabilities of the GSM network).

BLUTOOTH HC05 MODULE

The HCO5 Bluetooth module is a versatile and widely used component in electronics projects that require wireless communication capabilities. It utilizes Bluetooth technology to enable seamless data transmission between devices over short distances. With its compact size and low power consumption, the HCO5 module is suitable for integration into various electronic systems, including Arduino projects, IoT devices, and remote-control applications. The HCO5 Bluetooth module typically operates in the 2.4 GHz ISM (Industrial, Scientific, and Medical) frequency band, offering compatibility with a wide range of devices and protocols. It supports Bluetooth 2.0 and Bluetooth

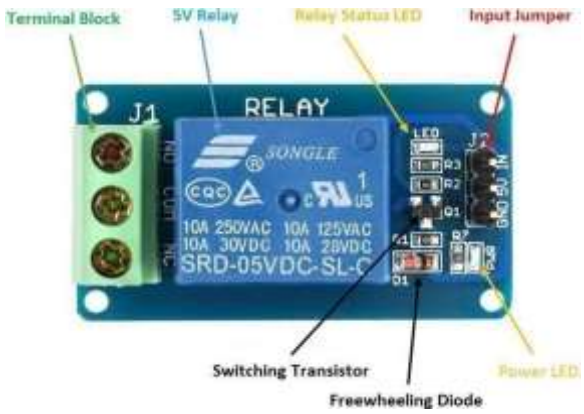
2.1 specifications, providing reliable connectivity and data transfer speeds of up to 2.1 Mbps. The module features a UART (Universal Asynchronous Receiver- Transmitter) interface for easy integration with microcontrollers and other serial devices. Additionally, it has a working voltage range of 3.3V to 6V, making it compatible with various power sources commonly found in electronic circuits. The HCO5 module employs the Serial Port Profile (SPP) for communication, allowing it to establish virtual serial links with other Bluetooth-enabled devices. This enables transparent data transmission between the module and its paired device, simplifying the integration process for developers. Pairing the HCO5 module with a host device typically involves a straightforward process of discovering nearby Bluetooth devices and initiating a connection using a PIN code or through automatic pairing, depending on the configuration.



- Bluetooth Version: The HC-05 module typically implements Bluetooth version 2.0 (often with Enhanced Data Rate, or EDR).
- Communication Range: Provides wireless communication with a typical range of
- approximately 10 meters (33 feet), though this can vary based on environmental factors and antenna design.
- Serial Communication: Supports serial communication (UART) for interfacing with microcontrollers or other devices.

Relay (5v)

Relay is an electromechanical device that uses an electric current to open or close the contacts of a switch. The single-channel relay module is much more than just a plain relay, it comprises of components that make switching and connection easier and act as indicators to show if the module is powered and if the relay is active or not.The single-channel relay module is much more than just a plain relay, it contains components that make switching and connection easier and act as indicators to show if the module is powered and if the relay is active.First is the screwterminalblock. Thisis thepartof the modulethatisin contact a reliable connectionis needed. Addingscrew terminalsmakesit easier to connect thick mains cables, which might be difficult to solder directly. The three connections on the terminal block are connected to the normally open, normally closed, and common terminals of the relay.The second is the relay itself, which, in this case, is a blue plastic case. Lots of information can be gleaned from the markings on the relay itself. The part number of the relay on the bottom says “05VDC”, which means that the relay coil is activated at 5V minimum – any voltage lower than this will not be able to reliably close the contacts of the relay. There are also voltage and current markings, which represent the maximum voltage and current, the relay can switch. For example, the top left marking says “10A 250VAC”, which means the relay can switch a maximum load of 10A when connected to a 250V mains circuit. The bottom left rating says “10A 30VDC”, meaning the relay can switch a maximum current of 10A DC before the contacts get damaged.The 'relay status LED' turns on whenever the relay is active and provides an indication of current flowing through the relay coil.The input jumper is usedto supply power to the relay coil and LEDs. The jumper also hasthe input pin, which when pulled high activates the relay.The switching transistor takes an input that cannot supply enough current to directly drive the relay coil and amplifies it using the supply voltage to drive the relay coil. This way, the input can be driven from a microcontroller or sensor output. The freewheeling diode prevents voltage spikes when the relay is switched off.The power LED is connected to VCC and turns on whenever the module is powered.



60 RPM Centre Shaft Economy Series DC Motor 60RPM Centre Shaft Economy Series DC Motor is high-quality low-cost DC geared motor. It has steel gears and pinions to ensure longer life and better wear and tear properties. The gears are fixed on hardened steel spindles polished to amirrorfinish. The output shaft rotates in a plastic bushing. The whole assembly iscovered with a plastic ring. Gearbox is sealed and lubricated with lithium grease and require no maintenance.

The motorisscrewed to the gear box from inside. Although motor gives 60 RPM at 12V but motor runs smoothly from 4V to 12V and giveswiderange of RPM, and torque. Tables below gives fairly good idea of the motor’s performancein termsof RPM andno loadcurrentas a functionof voltage andstalltorque,stall currentas a function of voltage.For compatible wheels refer to WheelsAccessories product category.You can also mount this motor on the chassis usingMotorMountfor Centre Shaft EcoomySeries DCMotorForaddingPosition Encoder, refer to Encoder Kit for Centre Shaft Economy Series DC Motor

LCD

Nowadays, we always use the devices which are made up of LCDs such as CD players, DVD players, digital watches, computers, etc. These are commonly used in the screen industries to replace the utilization of CRTs. Cathode Ray Tubes use huge power when compared with LCDs, and CRTs heavier as well as bigger. These devices are thinner as well power consumption is extremely less. The LCD 16×2 working principle is, it blocks the light rather than dissipate. This article discussesanoverviewof LCD 16X2, pinconfigurationanditsworking.The term LCD stands for liquid crystal display. It is one kind of electronic display module used in an extensive range of applications like various circuits & devices like mobile phones, calculators, computers, TV sets, etc. These displays are mainly preferred for multi-segment light-emitting diodes and seven segments. The main benefits of using this module are inexpensive; simply programmable, animations, and there are no limitations fordisplayingcustomcharacters,specialandevenanimatio ns, etc.

SOS BUTTON

SOS Button Functionality: The SOS button serves as a critical feature in yourproject, allowing the user to send

distress signals or call for help in emergency situations. When pressed, it triggers predefined actions or alerts to notify designatedcontactsorauthoritiesabouttheuser'slocationandsituation.Implementation with Arduino: To implementthe SOSbuttonfunctionalityusingArduino, you would typically connect the button to one of the digital input pins of the Arduino board. When the button is pressed, it sends a digital signal to the Arduino,whichthenactivatestheprogrammedrespo nse.Pins of SOS Button: The specific pins used for connecting the SOS button to theArduino depend on your hardware setup. Generally, any digital input pin can be used. You wouldconnect one terminalof the button to the chosen digital pin on theArduinoand the other terminal to either the ground (GND) pin or a voltage source (VCC), depending on the button's configuration (normally open or normallyclosed).

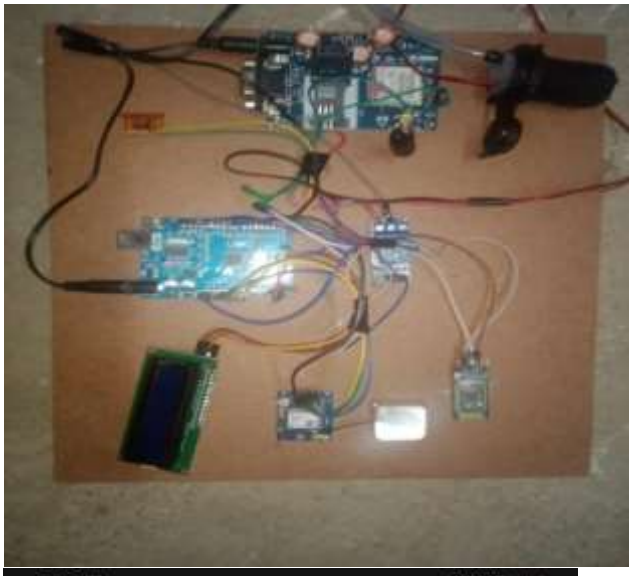
Advantages

- EnhancedSecurity:Utilizesencryptionandauthentic ationprotocolstoprevent unauthorizedaccessandensuredataintegrity.
- RealtimeTracking:UsesGPSorothertrackingtechnol ogiestocontinuouslymonitorthelocationoftheasseto rindividual.
- AutomatedLockingSystem:Integrateswithelectroni clocksoraccesscontrol systems to automatically secure or unlock doors or compartments based on predefined criteria.
- ImmediateAlertNotifications:Sendsnotificationsvi aSMS,email,ormobile appalertstonotifyusersofspecificeventsor triggers, suchasunauthorized accessoremergencies.
- UserConvenience:Offersintuitiveinterfacesandsea mlessintegrationwith mobiledevicesforeasymonitoringandcontrolofsecur ityfeatures.
- DurableandReliableDesign:Builtwithrobustmateria lsandcomponentsto withstand harsh environments and ensure long-term functionality.

Applications

- PersonalAssetManagement:Enablesindividualstotr ackandsecurepersonal belongings,suchasvehicles, luggage, orelectronicdevices.
- Traveland Tourism: Provides travelers with peace ofmindbyofferinglocationtrackingandsecurityfeatu resfortheirbelongingsduringjourneys.
- Educational Use: Facilitates asset tracking and securityineducationalinstitutions,suchastrackingsc hoolbusesorsecuringvaluableequipment.
- EmergencySituations:Allowsforquickresponseand assistanceinemergenciesbyprovidingrealtimetracki ngandalertcapabilities.
- HealthcareSector:Supportstrackingofmedicalequip mentandsupplies,aswellasensuringthesafetyandsec urityofpatientsan dstaff.
- CorporateSecurity:Enhancessecuritymeasuresincorp orateenvironmentsbyenablingrealtimetrackingofasset sandautomatedaccesscontrolsystems.

RESULT AND DISCUSSION



The output of the smart bag for women safety using arduino,as a message is byintegrating a small display screen into the smart bag.when a safety feature is triggered,the display screen can show a message indicating that help is on theemergency alert has been sent

CONCLUSION

In conclusion, the development of the smart bag utilizing Arduino, along with a switch, motor, GPS, GSM, and buzzer, represents a significant advancement in personal asset management and security. This project successfully integrated various technologies to create a product that not only enhances the security of personal belongings through real-time tracking and automated locking mechanismsbutalso improvesuser convenience with immediate alert notifications. The smart bag's robust and reliable design further ensures its applicability in a wide range of environments, from travel and tourism to emergency healthcare situations. This innovation stands as a testament to the potential of integrating simple electronic components to solve complex real-world problems, paving the way for future developments in smart personal and corporate asset management systems.

FUTURESCOPE

- Biometric Authentication: Implement biometric sensors like fingerprint or voicerecognition for bag access, ensuring only authorized users can open it.IntrusionDetection:Integratesensorstodetectunauthorizedaccessattempts,triggeringalarmsornotificat ionstotheuser'ssmartphone.
- SmartLockingMechanism:Developalockingsystem thatautomatically engages when the bag is moved away

from the user, deterring theft or unauthorizedaccess.

- RFIDTagging:UtilizeRFIDtechnologytotagvaluabl eitemswithinthebag, allowing for easy inventory management and alerting the user if items are missing.
- Temperature and Humidity Sensors: Include sensors to monitor the bag's internalenvironment,providingalertsifextremetemp eraturesorhumidity levels are detected, which could damage belongings like electronics or medication.
- ShockDetection:Incorporatesensorstodetectsudd enmovementsor impacts,indicating potential theft or physicalaltercation, and triggering alerts accordingly.
- Automatic Distress Call: Implement a feature that automaticallycontactspredefinedemergencycontactso rauthoritiesincaseofspecificpredefined events,suchasprolongedperiodsofinactivityorunusual sensorreadings.
- EnvironmentalMonitoring:Utilizesensorstomonitorai rqualityor pollutionlevels in the bag's vicinity, providing users with real-time information abouttheir environment.
- Integration with Personal Safety Devices: Partner with manufacturers of personalsafetydevices, suchaspeppersprayorpersonalalarms, tointegrate themseamlesslyintothedesignofthesmartbagforadded protection.
- UVSterilization:IncorporateUVClighttechnologyinto thebag'sdesignto sterilize surfaces and kill bacteria or viruses, promoting cleanliness and hygiene.

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